

PATENT APPLICATION

Inventor: Josh Tyler

Title: Pallet Rack

## BACKGROUND OF THE INVENTION

### Field of the Invention:

(0001) The present invention relates generally to pallet racks and, more particularly, to pallet racks having a lower pallet unit and an upper pallet unit supported on top of the lower pallet unit via connectors.

### Discussion of the Related Art:

(0002) Pallets are used in various situations to support many various types of objects. A conventional warehouse-type pallet typically includes a plurality of stringers extending longitudinally in spaced parallel relation and an upper deck secured to top sides of the stringers to provide a horizontal platform or support surface for supporting one or more objects. Commonly the stringers are wooden boards which have a length, width and thickness, and are positioned with their width oriented vertically or perpendicular to the horizontal surface of the upper deck. The upper deck is ordinarily made up of a plurality of wooden boards extending longitudinally in a direction transverse or perpendicular to the stringers. The deck boards typically have a length, width and thickness, and are positioned with their width oriented horizontally and supported on the top thickness of the stringers such that the deck platform presents an essentially flat support surface. The upper deck is supported by the stringers and conventional pallets usually have a lower deck, similar to the upper deck but secured to the bottom sides of the stringers. The bottom thickness of the stringers typically rests upon the width of the lower deck boards. The upper and lower deck boards may be secured to the stringers in any suitable way, typically using screws. Conventional pallets are usually square or nearly square in perimetrical or peripheral

configuration defining a footprint with a first pair of opposing parallel sides and a second pair of opposing parallel sides perpendicular to and connecting the first pair of sides at four corners.

**(0003)** When a pallet is laid flat on the ground or floor, the upper deck is elevated from the ground or floor and various types and numbers of objects may be loaded onto the upper deck to be supported thereon. Typically, pallets can be laid on the ground or floor with either the upper deck or the lower deck on top to provide a support surface for the object or objects. An object or objects supported on the support surface of the pallet is/are protected by virtue of being elevated from the ground or floor. A loaded or unloaded pallet may be moved from place to place, typically using a forklift or other suitable machinery, by which the pallet may be lifted off the ground or floor, transported, and placed back down on the ground or floor. Pallets are frequently used in various types of facilities to store objects thereon while allowing the pallets to be moved from place to place. Oftentimes, loaded pallets are placed on trucks or other carriers at one destination for transport to another destination where the loaded pallets are unloaded from the carriers.

**(0004)** When a loaded pallet is moved or transported, it is desirable that the object or objects on the pallet be constrained against falling off the pallet, especially where the object or objects is/are fragile or breakable and/or the pallet is being transported or moved a substantial distance. In many cases, it is desirable for packing material to be placed around the object or objects for protection and/or stability, and sometimes it is desirable to apply the packing material after the object or objects has/have been loaded on

the pallet. It is therefore important that the pallet be able to accommodate and facilitate the application of packing material, and also to accommodate and facilitate removal of the packing material prior to the object or objects being unloaded from the pallet.

**(0005)** To increase the number of objects that may be placed on an individual pallet, it is oftentimes desirable to arrange the objects in vertically stacked rows on the support surface of the pallet so that a greater number of objects can be accommodated on the pallet. By arranging objects in vertically stacked rows on a pallet, the number of objects that may be accommodated on the ground or floor for a particular pallet footprint is also increased, thereby conserving ground or floor space. Where objects are arranged in vertically stacked rows on a pallet, however, it is important that the objects are stabilized or constrained against toppling and/or falling off the pallet. Since it may be desirable to apply packing material to the objects after being arranged in vertically stacked rows on the pallet, it is also important that the pallet be able to accommodate and facilitate the application of packing material to objects arranged in vertically stacked rows thereon and also to accommodate and facilitate removal of the packing material while the objects remain arranged in vertically stacked rows on the pallet.

**(0006)** In some cases it is advantageous to deposit a loaded pallet at a point of sale and for the loaded pallet to serve as a point of sale display for objects on the pallet. Where objects for sale are arranged in vertically stacked rows on a pallet located at a point of sale, it is preferable that the pallet include structure to stabilize the objects on the pallet while facilitating removal of the objects from the pallet in an orderly manner. Also, it is desirable

that the pallet and the stabilizing structure present an attractive appearance creating a favorable impression on the part of potential purchasers.

**(0007)** To further conserve ground or floor space and to further increase the number of objects that can be accommodated in a particular size pallet footprint, it is desirable to secure an upper pallet on top of a lower pallet in vertical spaced relation permitting objects to be placed on each pallet. A frame attached to the lower pallet may be used to support the upper pallet in vertical spaced relation on the lower pallet, and the upper pallet should be structurally connected to the frame to ensure that the upper pallet is secured to and does not fall off of the lower pallet. It is desirable to simplify attachment of the frame to the lower pallet and to simplify connection of the upper pallet to the frame. It is also desirable to facilitate detachment and removal of the upper pallet from the frame and lower pallet. Where a plurality of individual pallets are vertically arranged and the individual pallets have objects thereon in vertically stacked rows, it is beneficial that the vertically stacked objects be stabilized or constrained from toppling or falling off the individual pallets.

**(0008)** Pallet racks in which an upper pallet is secured in vertical spaced relation on top of a lower pallet are represented by U.S. Patents No. 2,495,711 to Fletcher, No. 2,579,685 to Loose, No. 2,895,186 to Franks, No. 2,922,530 to Skeppstedt, No. 2,941,772 to Thayer et al, No. 2,956,763 to D'Arca, No. 3,500,770 to Skubic, No. 3,608,503 to Marcheso, No. 4,002,126 to Bell et al, No. 4,368,675 to Propst et al, No. 4,673,092 to Lamson et al, No. 4,703,702 to Speicher, No. 5,598,787 to Pronk, Nos. 5,979,338 and 6,244,194 B1 to Salmanson et al, No. 6,286,792 B1 to Best, and No. 6,463,863 B1 to

Ishikawa et al. A pallet having a frame with diagonal stabilizers along the sides of the pallet is represented by U.S. Patent No. 3,405,665 to Slonim. U.S. Patent No. 6,402,167 B1 to Calleja and United States Patent Application Publication No. US2003/0094124 A1 to Wishart are illustrative of pallets having frames secured thereon for supporting shelves in vertical spaced relation of the pallets for the arrangement of objects in vertically stacked rows.

**(0009)** Some prior pallet racks require that the lower pallet and/or the upper pallet be customized such that conventional or standard warehouse-type pallets cannot be incorporated in the pallet racks. Some prior pallet racks utilize standard pallets but require that the pallets be extensively modified. The frames used in prior pallet racks to support an upper pallet on top of a lower pallet and the connecting structure used to connect the frames to the upper and lower pallets are in general very complex and require many individual parts. The structural complexity and the large number of individual parts required by many prior pallet racks greatly increase the time and labor associated with assembling the pallet racks and detaching the upper pallets from the lower pallets. The structural complexity and the number of parts associated with prior pallet racks also detract from their aesthetic appearance. Prior pallet racks are also lacking in consistency and uniformity of parts in that the same connecting structures used to connect the frame to the upper pallets cannot also be used to connect the frame to the lower pallets. The frames used in prior pallet racks are in general not designed to support a standard pallet in vertical spaced relation on another standard pallet and to also support shelves in vertical spaced relation on either or both of the pallets. Many prior pallet racks are not designed to provide

adequate stabilization for objects arranged in vertically stacked rows on the pallet while also allowing the pallets racks to be transportable. Rather, many prior pallet racks cannot be transported in a loaded condition without jeopardizing the safety and integrity of the objects carried on the pallets. The frames and connecting structures used in many prior pallet racks provide obstructions which interfere with the application and removal of packing material to objects loaded on the upper and lower pallets of the pallet rack.

(00010) In light of the foregoing, there is a need for a pallet rack in which a standard upper pallet is supported in vertical spaced relation on top of a standard lower pallet using a frame and connectors which are uncomplicated and present a minimal number of parts. There is also a need for a pallet rack which provides frame structure of sufficient strength and rigidity to support an upper pallet on a lower pallet and also to allow one or more shelves to be supported in vertical spaced relation over either or both of the upper and lower pallets. A need also exists for a pallet rack that simplifies and facilitates attachment of a frame to a lower pallet and attachment of an upper pallet to the frame. There is an additional need for a pallet rack which reduces the complexity and time associated with assembling the pallet rack and which also facilitates detachment of an upper pallet from a lower pallet of the pallet rack. Moreover, there is a need for a pallet rack providing sufficient stabilization for objects arranged in vertically stacked rows on either or both of upper and lower pallets of the pallet rack while still allowing the loaded pallet rack to be transported or moved from place to place. There is another need for a pallet rack that facilitates the application and removal of packing material to objects arranged on upper

and lower pallets of the pallet rack, and there is a further need for a pallet rack that is attractive in appearance.

### SUMMARY OF THE INVENTION

**(00011)** The present invention overcomes the aforementioned disadvantages of prior pallet racks in numerous ways. The present invention simplifies assembly of a pallet rack, reduces the number of different parts required in a pallet rack, provides greater support and stability for an upper pallet supported on a lower pallet of a pallet rack, provides stabilization for objects supported on upper and lower pallets of a pallet rack including objects supported in vertically stacked rows on the upper and lower pallets of the pallet rack, and allows conventional or standard pallets to be used as the upper and lower pallets in a pallet rack without requiring substantial modifications to the conventional pallets. The present invention simplifies the frame structure used to support an upper pallet in vertical spaced relation on a lower pallet and simplifies the connecting structure used to connect the upper pallet to the frame structure. The present invention utilizes connectors to connect the upper pallet in supporting relation on the frame, and further allows the same type of connectors to be used to attach the frame to the lower pallet. The upper pallet may be provided with a frame of the same type as the lower pallet, and shelves may be supported on either or both of the frames in vertical spaced relation allowing objects to be arranged on either or both of the pallets in vertically stacked rows.

**(00012)** Some of the advantages of the present invention are that the time and labor needed to assemble the pallet rack is reduced; the same type of frame may be used with



the upper and lower pallets of the pallet rack for greater consistency and uniformity of parts; attachment of the upper pallet on the frame of the lower pallet and detachment of the upper pallet from the frame of the lower pallet are both facilitated; various objects may be loaded onto the lower pallet and/or the upper pallet of the pallet rack; the pallet rack may be transported or moved from place to place in a loaded or unloaded condition; a pallet rack having objects loaded thereon may be placed on a truck or other carrier for transport from one destination to another; objects arranged in vertically stacked rows on the lower and/or upper pallets are prevented from toppling; stabilizing bars are provided along each side of the pallet; some of the stabilizing bars are removable from the frames to provide access to objects on the pallets; some of the stabilizing bars are permanently affixed to the frames to provide structural strength and rigidity to the frames and to constrain objects on the pallets even when the removable stabilizing bars are removed; the pallet rack facilitates the application of packing material around objects disposed on the pallets including around objects disposed on the pallets in vertically stacked rows; the pallet rack facilitates the removal of packing material from objects disposed on the pallets without requiring that the objects, including those disposed on the pallets in vertically stacked rows, be moved or rearranged; the pallet rack is particularly suitable for holding fragile objects and for protecting fragile objects against damage when the pallet rack is transported or moved with the objects loaded thereon; and the pallet rack presents an attractive appearance conducive to use as a point of sale display.

**(00013)** The above and other features and advantages and benefits are realized with the present invention as generally characterized in a pallet rack comprising a lower pallet

unit, an upper pallet unit and a plurality of connectors connecting the upper pallet unit on top of the lower pallet unit. The lower pallet unit includes a lower pallet and a frame attached to the lower pallet. The lower pallet has a horizontal upper surface presenting a support surface for an object or objects, and the frame includes a plurality of vertical posts extending upwardly from the upper surface. The posts have lower portions secured to the lower pallet and upper portions having longitudinal passages terminating at upper ends circumscribing entry openings. The upper pallet unit includes an upper pallet having a lower surface, a horizontal upper surface presenting a support surface for an object or objects, and a plurality of longitudinal bores in the upper pallet with entry apertures along the lower surface. The bores are respectively longitudinally aligned with the longitudinal passages of the posts of the lower pallet unit when the upper pallet is disposed over the lower pallet in parallel spaced relation. The connectors connect the upper pallet to the posts and have upper extensions respectively received in the bores of the upper pallet, lower extensions respectively received in the passages of the posts, and support flanges respectively disposed between the lower surface of the upper pallet and the upper ends of the passages. The flanges are of an external size preventing passage of the flanges through the entry openings of the passages and the entry apertures of the bores. The lower surface of the upper pallet is supported on respective upper faces of the flanges, and lower faces of the flanges are supported respectively on the upper ends of the passages with the upper pallet being in spaced parallel relation with the lower pallet.

**(00014)** The pallets may be conventional wooden warehouse-type pallets with parallel stringers extending along opposite sides of the pallet and the upper surfaces of the pallets

supported on the top sides of the stringers. The bores in the upper pallet may extend within the stringers disposed on the opposite sides of the upper pallet. Each pallet may have a perimeter or footprint defining four corners, with the posts respectively disposed adjacent the corners of the lower pallet and the bores respectively disposed adjacent the corners of the upper pallet. The upper extensions of the connectors may be disposed in the bores with a close fit, and the lower extensions of the connectors may be disposed in the passages with a close fit. The upper and lower extensions of each connector are coaxial, and the support flange of each connector may include a circular flange between the upper and lower extensions.

**(00015)** The lower portions of the posts may be secured to the lower pallet in various ways. In one form of securement, a securing device comprising a base plate extends perpendicularly from the lower portion of each post and is attached in supporting relation on the upper surface of the lower pallet. In another form of securement, securing devices comprising an additional plurality of the connectors are used to respectively couple the lower portions of the posts to the lower pallet. The lower portions of the posts may respectively have longitudinal passages terminating at lower ends circumscribing entry openings for receiving the upper extensions of the additional plurality of connectors. The lower pallet may have a plurality of longitudinal bores therein with entry apertures along the upper surface of the lower pallet for receiving the lower extensions of the additional plurality of connectors, with the flanges of the additional plurality of connectors being disposed between the lower ends of the passages and the upper surface of the lower pallet. The posts may be tubular with a lumen extending entirely therethrough defining the

longitudinal passages at the upper and lower portions. Alternatively, the passages at the upper and lower portions of each post may be constituted by separate and distinct passages in the post. The passages at the upper and/or lower portions of each post may be constituted by a separate receptacle attached to the posts.

**(00016)** The upper pallet unit may include a frame including a plurality of vertical posts in longitudinal alignment with the posts of the lower pallet unit. The posts of the upper pallet unit have lower portions secured to the upper pallet and upper portions terminating at upper ends. The lower portions of the posts of the upper pallet unit may be secured to the upper pallet in the same manner that the lower portions of the posts of the lower pallet unit are secured to the lower pallet. Accordingly, the posts of the upper pallet unit may be secured to the upper pallet using securing devices such as base plates or an additional plurality of the connectors. Alternatively, the same connectors used to secure the upper pallet on the posts of the lower pallet unit may be used to secure the posts of the upper pallet unit on the upper pallet. The posts of the lower pallet unit may comprise two front posts and two back posts, and the posts of the upper pallet unit may similarly comprise two front posts and two back posts. Each pallet unit may include a front stabilizing bar extending diagonally between its front posts, a rear stabilizing bar extending diagonally between its back posts, and two side stabilizing bars respectively extending diagonally between the front posts and the back posts. Some of the stabilizing bars, e.g. the front and rear stabilizing bars, are removable while some of the stabilizing bars, e.g. the side stabilizing bars, are non-removable. The posts may include brackets or attachment devices for attachment to ends of the stabilizing bars. The ends of the removable

stabilizing bars may be secured to abutment plates removably attached to the attachment devices via securing elements. Each pallet unit may include one or more horizontal shelves secured to its posts in spaced parallel relation over the upper surface of the pallet. The shelves may be fixed or adjustable. The pallet units may be essentially identical so that either pallet unit may be used as the upper pallet unit or the lower pallet unit.

(00017) Other features and advantages of the present invention will become apparent from the following description of the preferred embodiments taken in conjunction with the accompanying drawings wherein like parts in each of the several figures are identified by the same reference characters.

#### BRIEF DESCRIPTION OF THE DRAWINGS

(00018) Fig. 1 is an exploded perspective view of a pallet rack according to the present invention.

(00019) Fig. 2 is a perspective view depicting a lower pallet unit of the pallet rack in an assembled condition and depicting a plurality of connectors assembled to a frame of the lower pallet unit for supporting an upper pallet unit of the pallet rack thereon.

(00020) Fig. 3 is a broken perspective view depicting insertion of an extension of a connector into a longitudinal passage of a post of the frame.

(00021) Fig. 4 is a perspective view illustrating the assembled upper pallet unit supported on the assembled lower pallet unit via the connectors.

(00022) Fig. 5 is a broken perspective view depicting an attachment device for removable attachment of a stabilizing bar to a post of the frame.

(00023) Fig. 6 is a broken perspective view showing a connector supporting the upper pallet unit on a post of the lower pallet unit.

(00024) Fig. 7 is a front view of a loaded pallet unit having objects supported thereon in vertically stacked rows.

(00025) Fig. 8 is a perspective view of the loaded pallet unit of Fig. 7 with packing material applied around the objects.

(00026) Fig. 9 is a perspective view showing the loaded pallet unit of Fig. 8 assembled with another similar loaded pallet unit to form the pallet rack.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

(00027) A pallet rack 10 according to the present invention is illustrated in Fig. 1 in an unassembled condition. The pallet rack 10 comprises a lower pallet unit 12, an upper pallet unit 14 and a plurality of connectors 16 for connecting the upper pallet unit 14 in supporting relation on the lower pallet unit 12. The lower pallet unit 12 comprises a lower

pallet 18 and a frame 20 attached to the lower pallet 18. The lower pallet 18 has a lower surface 21 for being supported on the ground, floor or other support surface and an upper surface 22 on which one or more various objects may be supported. The lower pallet 18 may have a perimeter or footprint of square or nearly square configuration defining four corners. The lower pallet 18 may be a conventional warehouse-type pallet comprising a plurality of stringers 23 and an upper deck 24 secured to and supported on top sides of the stringers 23. The stringers 23 may be boards having a length, width and thickness, with the width of the stringers oriented vertically. The stringers 23 extend longitudinally in spaced parallel relation. The upper deck 24 may include a plurality of deck boards having a length, width and thickness, with the width of the deck boards oriented horizontally or perpendicular to the width of the stringers 23. The deck boards extend longitudinally in a direction transverse or perpendicular to the direction of stringers 23, and the deck boards are supported on the top thickness of the stringers such that the upper deck 24 defines an upper or support surface 22 that is essentially flat or planar and horizontal. The deck boards may be in spaced parallel relation. The lower pallet 18 may include a lower deck 26 defining the lower surface 21 of the pallet. The lower deck 26 may be similar to the upper deck 24 and may comprise a plurality of deck boards extending longitudinally in a direction transverse or perpendicular to the stringers 23 with their width oriented horizontally and the bottom thickness of the stringers supported on the lower deck boards. The stringers 23, the upper deck 24 and the lower deck 26 may all be made of wood with the deck boards secured to the stringers in any suitable way such as screws.

**(00028)** Where the upper deck 24 is made up of a plurality of deck boards, the upper deck 24 and upper surface 22 may be considered discontinuous. However, it should be appreciated that either or both of the upper deck 24 and the lower deck 26 may comprise a continuous solid panel secured to the stringers 23. Accordingly, either or both of the lower surface 21 and the upper surface 22 of the lower pallet 18 may be continuous.

**(00029)** The lower pallet 18 has a first pair of opposing parallel sides and a second pair of opposing parallel sides perpendicular to the first pair of sides at four corners. A pair of side stringers 23 respectively extend along the first pair of parallel sides. The lower pallet 18 has a thickness at each corner defined in the vertical direction. Where the lower pallet 18 is constructed of stringers 23 and upper deck 24, the thickness of the lower pallet at each corner includes the width of the side stringer 23 and the thickness of the upper deck 24. Where the pallet 18 is constructed of stringers 23, upper deck 24 and lower deck 26, the thickness of the pallet at each corner includes the width of the side stringer 23, the thickness of the upper deck 24 and the thickness of the lower deck 26.

**(00030)** When the lower pallet 18 is laid flat on the ground, floor or other support surface with its lower surface 21 resting on the ground, floor or other support surface, the upper surface 22 of the pallet is elevated from the ground, floor or other support surface. Various types and numbers of objects may be loaded onto the upper surface 22 of the pallet 18 to be supported thereon. An object or objects supported on the upper surface 22 is/are protected by virtue of being elevated from the ground, floor or other support surface. A loaded or unloaded pallet 18 may be moved from place to place, typically using a forklift



or other suitable machinery by which the pallet may be lifted off of the ground, floor or other support surface, transported or moved, and placed back down onto the ground, floor or other support surface. In the case of a forklift, the lifting fork of the forklift may be inserted beneath the upper deck 24 of the pallet 18 so that the upper deck 24 is supported on the lifting fork.

**(00031)** The frame 20 comprises a plurality of vertical posts 28 and a plurality of stabilizing bars 29a, 29b, 29c and 29d extending between the posts. Each post 28 has a lower portion 30 for being secured to the lower pallet 18 and an upper portion 31 having a longitudinal passage 34 terminating at an upper end 32 circumscribing an entry opening. Preferably, the plurality of posts comprises four posts 28, with a post 28 provided for each corner of the lower pallet 18. Preferably, the posts 28 are respectively secured to the lower pallet in alignment with the width of the side stringers 23 at, adjacent or close to the corners and within the perimeter or footprint of the lower pallet. The posts 28 extend longitudinally in the vertical direction upwardly from the upper surface 22 of the lower pallet 18 with the central longitudinal axes of the posts perpendicular to the upper surface 22. The posts 28 are thusly parallel to one another and are arranged to define four corners. The distance from the upper surface 22 of the pallet 18 to the upper ends 32 of the passages 34 is essentially the same for each post. The posts 28 are longitudinally straight and may have a cylindrical external configuration with a circular external cross-sectional configuration. However, the posts 28 can have non-cylindrical external configurations and non-circular external cross-sectional configurations. Each post 28 may have the longitudinal passage 34 extending coaxially in its upper portion 31 and may have the upper

end 32 of the passage 34 coincident with the upper end of the post. The upper ends 32 may each comprise a protruding peripheral rim or lip 33 circumscribing the entry opening to the passage 34. The passages 34 have a size and configuration to respectively receive lower extensions of connectors 16 with a close fit as explained further below. The passages 34 are of sufficient length to receive the length of the lower extensions. The longitudinal passages 34 may be cylindrical with a circular cross-sectional configuration. Where the longitudinal passages 34 are formed within the posts 28, the passages 34 may terminate within the posts 28 or the posts 28 may be tubular with each post having a lumen or passage extending entirely therethrough defining the longitudinal passage 34. It should be appreciated that the passages 34 can be formed in receptacles respectively attached to the upper portions of the posts 28. The posts 28 are preferably made of metal of sufficient strength and rigidity to support the weight of the upper pallet unit 14, including the weight of an object or objects supported by the upper pallet unit.

(00032) A connector 16 is provided for each post 28 and, therefore, the plurality of connectors preferably comprises four connectors 16. Each connector 16 comprises a support flange 36 having a lower face and an upper face, a lower extension 37 extending longitudinally from the lower face of the support flange 36, and an upper extension 38 extending longitudinally from the upper face of the support flange. The lower and upper extensions 37 and 38 are coaxial with a common central longitudinal axis. The extensions 37 and 38 may be cylindrical with a circular configuration in external cross-section. The lower and upper extensions 37 and 38 may be essentially identical with the same external cross-section and dimensions and the same length extending from flange 36 so that either

extension 37 or 38 may be used as the lower extension or the upper extension to simplify assembly of the pallet rack 10. However, it should be appreciated that the length of the extensions 37 and 38 extending from flange 36 may be different from one another.

**(00033)** The support flange 36 of each connector 16 is larger in external size than the extensions 37 and 38. In the case of connectors 16, the support flange 36 has a circular external configuration with a diametric size larger than the external diametric sizes of the extensions 37 and 38. However, it should be appreciated that the support flanges 36 may have other configurations. The support flanges 36 may be planar or nearly planar and of relatively minimal thickness. Each connector 16 may be fabricated with its support flange 36 formed by a circular plate and its lower and upper extensions 37 and 38 formed by a one-piece rod extending through a central hole in the circular plate with the plate being attached to the rod. The support flanges 36 have an external size to prevent passage of the support flanges through the entry openings of the longitudinal passages 34 at the upper ends 32 when the lower extensions 37 are disposed in the passages 34. Preferably, the flanges 36 have an external size such that the lower faces of the flanges overlap the rims 33 at the upper ends 32 when the lower extensions 37 are received in the passages 34. The connectors 16 are preferably made of metal of sufficient strength and rigidity. The rods forming the lower and upper extensions may be attached to the plates which form the support flanges in any suitable way include welding.

**(00034)** The posts 28 may be considered as comprising a pair of front posts (left and right) and a pair of back or rear posts (left and right) in respective alignment with the front

posts. The stabilizing bars include a front stabilizing bar 29a for extending between the left and right front posts, a rear stabilizing bar 29b for extending between the left and right rear posts, a left side stabilizing bar 29c for extending between the left front post and the left rear post, and a right side stabilizing bar 29d for extending between the right front post and the right rear post. The front stabilizing bar 29a is designed to extend from the lower portion of one front post to the upper portion of the other front post. In the illustrated embodiment, the front stabilizing bar 29a extends from the lower portion of the left front post to the upper portion of the right front post. The rear stabilizing bar 29b is designed to extend from the lower portion of one rear post to the upper portion of the other rear post. In the illustrated embodiment, the rear stabilizing bar 29b extends from the upper portion of the left rear post to the lower portion of the right rear post. The left side stabilizing bar 29c is designed to extend from the lower portion of one of the left front or left rear posts to the upper portion of the other of the left front or left rear posts. In the illustrated embodiment, the left side stabilizing bar 29c extends from the lower portion of the left front post to the upper portion of the left rear post. The right side stabilizer bar 29d is designed to extend from the lower portion of one of the right front or right rear posts to the upper portion of the other of the right front or right rear posts. In the illustrated embodiment, the right side stabilizer bar 29d extends from the upper portion of the right front post to the lower portion of the right rear post.

**(00035)** Each stabilizing bar 29a, 29b, 29c and 29d is elongate with opposing ends for being respectively attached to a pair of posts 28. Accordingly, each post 28 is designed to have one end of two different stabilizing bars attached thereto, and each post 28 may

include an attachment device 40 for attaching the ends of the stabilizing bars thereto. The attachment devices 40 are located along the lower portions 30 or the upper portions 31 of the posts 28 depending on where the ends of the stabilizing bars attach to the posts. As best seen in Fig. 5, each attachment device 40 includes two attachment plates 41 extending from the associated post 28 perpendicular to the central longitudinal axis of the post and at a right angle to one another. The attachment device 40 for the left front post 28 is located on the lower portion of the left front post with a front attachment plate 41 extending from the left front post in the direction of the right front post and a left side attachment plate 41 extending from the left front post in the direction of the left rear post. The attachment device 40 for the right front post is located on the upper portion of the right front post with a front attachment plate 41 extending from the right front post in the direction of the left front post and a right side attachment plate 41 extending from the right front post in the direction of the right rear post. The attachment device 40 for the left rear post is located on the upper portion of the left rear post with a rear attachment plate 41 extending from the left rear post in the direction of the right rear post and a left side attachment plate 41 extending from the left rear post in the direction of the left front post. The attachment device 40 for the right rear post is located on the lower portion of the right rear post with a rear attachment plate 41 extending from the right rear post in the direction of the left rear post and a right side attachment plate 41 extending from the right rear post in the direction of the right front post. The attachment plates 41 may be made of metal and may be attached to the associated posts 28 by welding.

**(00036)** The side stabilizing bars 29c and 29d are non-removably attached to the corresponding posts 28 and are essentially a permanent part of the frame 20. The ends of the left side stabilizing bar 29c are respectively attached to the left side attachment plates 41 on the left front and left rear posts 28. The ends of the right side stabilizing bar 29d are respectively attached to the right side attachment plates 41 on the right front and right rear posts 28. Preferably, the ends of the left side stabilizing bar 29c are respectively secured along inner surfaces of the left side attachment plates 41 of the left front and left rear posts 28, and the ends of the stabilizing bar 29c may be secured to the left side attachment plates in various ways. One suitable way of establishing a non-removable or essentially permanent attachment between the ends of the left side stabilizing bar 29c and the left side attachment plates 41 of the left front and left rear posts 28 is by welding the ends of the left side stabilizing bar to the left side attachment plates. Similarly, the ends of the right side stabilizing bar 29d are respectively attached to the right side attachment plates 41 of the right front and right rear posts 28 such that the right side stabilizing bar 29d is also non-removable and essentially permanent. The ends of the right side stabilizing bar 29d may be secured, such as by welding, along the inner surfaces of the right side attachment plates 41 of the right front and right rear posts 28.

**(00037)** At least one of the front or rear stabilizing bars 29a and 29b is removably attached to the corresponding post 28 and, preferably, both the front and rear stabilizing bars 29a and 29b are removably attached to the corresponding posts. As shown in Fig. 5 for the front stabilizing bar 29a, the ends of the front stabilizing bar 29a are respectively attached to inner surfaces of abutment plates 44, and the ends of the front stabilizing bar

may be welded to the abutment plates. The abutment plates 44 have planar outer surfaces for abutment with the planar inner surfaces of the front attachment plates 41 on the left front and right front posts 28. As best seen in Fig. 5, each abutment plate 44 has a hole 45 therethrough and the front attachment plates 41 of the left front and right front posts 28 have respective holes 46 therethrough for respective alignment with the holes in the abutment plates 44 on the front stabilizing bar 29a. The abutment plates 44 on the front stabilizing bar 29a may be removably secured to the front attachment plates 41 on the left front and right front posts 28 via securing elements comprising externally threaded bolts 48 inserted through the aligned holes 45 and 46 and secured in place via nuts 49 tightened on the bolts 48. Similarly, the rear stabilizing bar 29b has abutment plates 44 on its respective ends removably securable to the rear attachment plates 41 on the left back and right rear posts 28.

**(00038)** It should be appreciated that the non-removable stabilizing bars 29c and 29d may be non-removably or essentially permanently attached to the respective posts 28 directly, without the attachment plates or other intervening structure. It should also be appreciated that the removable stabilizing bars 29a and 29b can have their ends removably attached or secured to the respective posts directly, without the attachment plates and abutment plates.

**(00039)** The frame 20 is secured on the lower pallet 18, and the lower pallet unit 12 comprises a plurality of securing devices 50 for securing frame 20 on pallet 18. A securing device 50 is provided for each post 28 of the lower pallet unit 12 and the securing devices

50 respectively secure the lower portions 30 of the posts 28 to the pallet 18. The securing devices 50 may be designed in many various ways and, in the case of lower pallet unit 12, each securing device 50 is a connector the same as connectors 16. The plurality of securing devices 50 thusly comprises an additional plurality of connectors 16, allowing the securing devices 50 and connectors 16 to be used interchangeably for greater simplicity, uniformity of parts and ease of assembly. Accordingly, each securing device 50 has a support flange 36, a lower extension 37 and an upper extension 38 as described above for connectors 16. A longitudinal bore 52 is formed in the lower pallet 18 at the designated location for each post 28 and, therefore, four bores 52 are formed in the thickness of pallet 18 at, adjacent or near the corners of the pallet 18. The bores 52 extend longitudinally in the vertical direction and have entry apertures along the upper surface 22 of lower pallet 18. The bores 52 are of a size and configuration to receive the lower extensions 37 of the securing devices 50 with a close fit, with the entry apertures of the bores 52 being of a size to prevent the flanges 36 of the securing devices from passing therethrough when the lower extensions 37 of the securing devices are received in the bores 52. The lower portions 30 of posts 28 have respective longitudinal passages 54 terminating at lower ends 53 circumscribing entry openings to the passages 54. The lower ends 53 may be coincident with the lower ends of the posts 28. The longitudinal passages 54 are coaxial with the passages 34 and bores 52, and are of sufficient length to receive the length of the upper extensions 38 of securing devices 50. The longitudinal passages 54 may be formed coaxially within the posts 28 separate from the passages 34. Where the posts 28 are tubular with a lumen or passage extending entirely therethrough, the longitudinal passages 34 and 54 may be formed by one continuous lumen or passage through the posts. The



longitudinal passages 54 may be formed in receptacles respectively attached to the posts 28. The lower ends 53 may comprise protruding rims 33 as described for the upper ends 32. The upper extensions 38 of securing devices 50 are respectively receivable in the longitudinal passages 54 with a close fit. The upper extensions 38 of securing devices 50 are insertable in the longitudinal passages 54 through the entry openings at lower ends 53, and the entry openings at lower ends 53 are of a size to prevent passage of the flanges 36 therethrough. Accordingly, when the lower extensions 37 of securing devices 50 are respectively received in bores 52 and the upper extensions 38 of securing devices 50 are respectively received in the passages 54, the lower faces of the support flanges 36 of the securing devices 50 are in supporting relation on the upper surface 22 of pallet 18, and the lower ends 53 are in supporting relation on the upper faces of the flanges 36 of the securing devices. The lower extensions 37 terminate within the thickness of the lower pallet unit 18 and do not protrude beyond the lower surface 21, thusly allowing the lower surface of the lower pallet to be laid flat on the ground, floor or other support surface. Instead of using connectors 16 as the securing devices 50, the securing devices 50 for the lower pallet unit 12 may comprise base plates as described below for securing devices 150 of the upper pallet unit 14.

**(00040)** When the frame 20 is secured on the lower pallet 18, the entire frame 20 is within the periphery or footprint of the pallet 18. Where pallet 18 is a standard warehouse-type pallet, the only modification needed to the pallet is the formation of bores 52. Where the pallet 18 is constructed of stringers 23 and upper deck 24, the bores 52 for the left front and left rear posts 28 pass through the thickness of upper deck 24 into the width of a left

side stringer 23 while the bores 52 for the right front and right rear posts 28 pass through the thickness of upper deck 24 and into the width of a right side stringer 23, the bores 52 being of sufficient length to accommodate the length of the lower extensions 37 of the securing devices 50. The lower pallet unit 12 may be provided with decorative trim 55 and, as shown for the illustrated embodiment, the decorative trim 55 may be secured on the front posts 28 and may serve to identify the front of the lower pallet unit 12 and thusly the location of removable stabilizing bar 29a. The trim 55 may comprises scroll work or any other decoration and may extend longitudinally along the posts 28. The trim 55 may be metal and may be welded to the posts 28.

**(00041)** The upper pallet unit 14 is similar to the lower pallet unit 12 except for the securing devices used to secure a frame of the upper pallet unit on the pallet of the upper pallet unit. The upper pallet unit 14 comprises upper pallet 118 and frame 120 secured on upper pallet 118. The upper pallet 118 has a lower surface 121 and a horizontal upper surface 122. The upper pallet 118 may be a conventional warehouse-type pallet made up of stringers 123, an upper deck 124 secured on top sides of the stringers 123, and a lower deck 126 secured on the bottom sides of the stringers 123 as described above for lower pallet 18. As best seen in Fig. 6, the upper pallet 118 has longitudinal bores 152 therein in coaxial correspondence with the upper extensions 38 of connectors 16. The bores 152 have entry apertures along the lower surface 121 of pallet 118 and the bores 152 extend longitudinally in a vertical direction in coaxial correspondence with the passages 34 of posts 28. The bores 152 are located in the upper pallet 118 at, adjacent or near the corners of the upper pallet and may be in longitudinal or axial alignment with the posts 28.

In the illustrated embodiment, the bores 152 for the left front and left rear posts 28 pass through the thickness of lower deck 126 into the width of a left side stringer 123 while the bores 152 for the right front and right rear posts 28 pass through the thickness of lower deck 126 into the width of right side stringer 123, the bores 152 being of sufficient length to accommodate the length of the upper extensions 38 of connectors 16. It should be appreciated that either pallet 18, 118 can be used as the upper pallet or the lower pallet simply by orienting the pallets so that the entry apertures of the bores 52, 152 are oriented to receive the appropriate extensions of the connectors. The pallets 18, 118 can also be used interchangeably where the bores 52, 152 extend entirely through the pallet.

**(00042)** The frame 120 for the upper pallet unit is similar to frame 20 except for the securing devices 150 by which the frame 120 is secured to the upper pallet 118. The frame 120 comprises posts 128 and stabilizing bars 129a, 129b, 129c and 129d as described above for frame 20. The posts 128 have lower portions 130 respectively secured to the upper pallet 118 via the securing devices 150 and have upper portions 131 terminating at respective upper ends 132. The upper ends 132 may be provided with protruding rims 133. The posts 28, 128 may be used interchangeably. However, the posts 128 secured to the upper pallet 118 via securing devices 150 need not receive the extensions of any connectors and thusly need not have any longitudinal passages. The upper pallet unit 14 includes attachment devices 140 comprising attachment plates 141 for attaching the stabilizing bars 129, 129b, 129c and 129d as described above for lower pallet unit 12.

**(00043)** As best seen in Fig. 6, the securing device 150 for each post 128 of the upper pallet unit 14 comprises a base plate 156 attached to the lower portion 130 of the post 128. The base plates 156 are perpendicular to the respective posts 128 and to the central longitudinal axes of the posts 128. The base plates 156 may be made of metal and may be attached to the lower portions 130 in any suitable way such as by being welded to the lower portions 130. Each base plate 156 has a planar bottom wall for abutment with the upper surface 122 of the upper pallet 118. The base plates 156 are secured in place on the upper surface 122 with the posts 128 at their designated locations, and the base plates 156 can be secured to the pallet 118 in many various ways. For example, the base plates 156 may be attached to the pallet 118 using bolts and/or screws.

**(00044)** It should be appreciated that the securing devices 150 may comprise another additional plurality of connectors 16 used as the securing devices 150 to attach the posts 128 to the upper pallet 118 in the same manner as described above for the securing devices 50. In this case, the lower portions 130 of posts 128 will have longitudinal passages terminating at lower ends 153 circumscribing entry openings to the passages as described above for passages 54 of posts 28. The passages at the lower portions 130 of posts 128 may be formed coaxially in the posts 128 or in receptacles attached to posts 128 as described above for passages 54. Lower extensions 37 of the another additional plurality of connectors 16 may be respectively received in the bores 152 via the entry apertures along upper surface 122, and the upper extensions 38 of the another additional plurality of connectors 16 may be respectively received in the longitudinal passages at the lower portions 130 of posts 128 with the flanges 36 of the another additional plurality of

connectors 16 in supporting relation on the upper surface 122 and the lower ends 153 of the passages in supporting relation on the flanges 36. It should be appreciated that the length of the lower extensions 37 of the connectors 16 used as the securing devices 150 for the upper pallet unit 14 and the length of the upper extensions 38 of the connectors 16 used to secure the upper pallet unit 14 on the posts of the lower pallet unit 12 can be adjusted as necessary to allow both the lower extension 37 and the upper extension 38 of the connectors to fit in each bore 152 simultaneously. It should be further appreciated that the same connectors 16 used to secure the upper pallet unit 14 on the posts of the lower pallet unit 12 may serve as the securing devices 150. As shown in dotted lines in Fig. 6, the upper extensions 38 of the connectors 16 used to secure the upper pallet unit 14 on the posts of the lower pallet unit 12 may be of sufficient length to respectively extend through bores 152 through the entire thickness of pallet 118 and into the longitudinal passages at the lower portions 130 of posts 128. Moreover, where connectors 16 are used as the securing devices 150 in the manner described above for the lower pallet unit, the lower extensions 37 of the connectors inserted through the entry apertures along upper surface 122 may be of sufficient length to respectively extend through bores 152 through the entire thickness of the upper pallet 118 so that the lower extensions protrude a sufficient distance from the lower surface 121 for insertion in the passages 34 of the posts 28 of the lower pallet unit. Fig. 2 illustrates in dotted lines a lower extension 37 of securing device 50 extending entirely through the pallet 18 to protrude beyond the lower surface 21 for this purpose, and Fig. 2 is also representative of the feature that either pallet unit 12 or 14 may be used interchangeably as the upper or lower pallet unit.

**(00045)** Fig. 2 depicts the lower pallet unit 12 in an assembled condition and with the lower extensions of connectors 16 respectively received in the longitudinal passages 34 at the upper portions of posts 28 so that the lower faces of flanges 36 rest upon the upper ends of the passages. Fig. 3 illustrates coaxial insertion of a lower extension 37 into the longitudinal passage 34 of a post 28. The upper pallet unit 14 in an assembled condition similar to or the same as the assembled lower pallet unit 12 is secured on top of the lower pallet unit 12 by aligning the bores 152 in the upper pallet 118 with the upper extensions 38 of connectors 16 and then moving the upper pallet 118 onto the connectors 16 so that the upper extensions 38 enter the entry apertures along the lower surface 121 of the upper pallet and are received in the bores 152 with a close fit with the flanges 36 sandwiched between the upper ends 32 of passages 34 and the lower surface 121 of upper pallet 118 to obtain the assembled pallet rack 10 shown in Fig. 4. Where the securing devices 150 are connectors 16 having lower extensions 37 protruding from the lower surface 121 of the upper pallet 118 as depicted in dotted lines in Fig. 2, the protruding lower extensions are aligned with the entry openings of passages 34 of posts 28, and the upper pallet 118 is moved toward the lower pallet 18 to insert the protruding extensions fully into the passages 34. In the latter case, the lower surface 121 of the upper pallet 118 will come to rest on the upper ends 32 of passages 34.

**(00046)** The pallet rack 10 obtained when the upper pallet unit 14 is supported on the lower pallet unit 12 provides a rigid interconnected structure of enhanced rigidity and strength. The pallet rack 10 comprises a minimum number of parts with many parts being interchangeable and/or usable in different positions or orientations. The frame of each

pallet unit is easy to assemble and is easy to secure to the corresponding pallet. The upper pallet unit is easy to assemble to the lower pallet unit. The upper pallet is disposed over the lower pallet in parallel spaced relation and the perimeters or footprints of the upper and lower pallets are in vertical alignment. No parts of the pallet rack protrude beyond the footprints of the pallets yet only a minimal amount of the upper surfaces of the pallets is taken up by the frames. The posts of the lower pallet unit are in longitudinal or axial alignment with the corresponding posts of the upper pallet unit. The flanges of the connectors provide weight distribution over a larger area for greater structural integrity and avoid the ends of the posts biting into the deck boards. The connectors provide greater resistance to tipping, sliding and bending. The stabilizing bars add strength and rigidity to the frames while providing a structural barrier along the front, rear and left and right sides of the pallets. Removability of the front and rear stabilizing bars provides convenient and unobstructed access to the pallets for loading objects on and unloading objects from the pallets. The pallet units may be transported and moved from place to place individually and the assembled pallet rack 10 may be transported and moved from place to place, with or without objects loaded thereon. The pallet rack 10 provides the storage space of more than one pallet unit within the footprint of a single pallet unit. Depending on the vertical height of each pallet unit, the pallet rack may comprise more than two pallet units secured one on top of the other. The storage space for each pallet unit may vary depending on the size of the pallet upper surface and/or the height of the frame.

**(00047)** The frames 20, 120 of each pallet unit may be used to support shelves in vertical spaced relation over the corresponding pallets 18, 118 to facilitate the arrangement

of objects on the pallets in vertically stacked rows. Fig. 4 illustrates each pallet unit 12 and 14 as having shelves 58, 158 supported by the frames 20, 120 in parallel spaced relation over the pallets 18, 118. Each shelf 58, 158 is attached along its perimeter to the posts 28, 128 of the frame 20, 120. In the case of pallet rack 10, the shelves 58, 158 have a perimeter of the same configuration but somewhat smaller than the perimeter of the pallets 18, 118 and defining four corners respectively attached to the posts 28, 128. The shelves 58, 158 may be designed in various ways and may be attached in various ways to the corresponding posts. The shelves 58, 158 are designed as wire or metal racks with slots or for openings for air flow, and the shelves 58, 158 may be attached to the corresponding posts by welding. The attachment by which shelves 58, 158 are secured to the corresponding posts may be fixed or adjustable. An adjustable attachment, such as using screws or bolts, allows the vertical positions for the shelves along the posts to be selectively adjusted to maximize storage space in accordance with the dimensions of the objects to be loaded onto the pallets. An adjustable attachment for shelves 58, 158 may be facilitated by forming the posts 28, 128 from lengths of L-shaped cross-section channel. In the latter case, the passages of the posts 28, 128 may be formed in receptacles attached to the posts such as by welding. It should be appreciated that the shelves 58, 158 may each be designed as a continuous solid surface. It should be further appreciated that the slotted shelves 58, 158 may each be provided with a solid surface or panel on top of the shelves prior to objects being placed thereon. In the pallet rack 10, the pallet units 12, 14 each have two shelves 58, 158 in spaced parallel relation over the pallets 18, 118 so that each pallet unit has a lower shelf disposed over the pallet in parallel spaced relation and an upper shelf disposed over the lower shelf in parallel spaced relation. Of course, it should



be appreciated that each pallet unit can have the same or a different number of shelves and that the number of shelves may vary depending on the vertical height of posts 28, 128.

In the illustrated embodiment, each pallet unit 12, 14 defines three support surfaces, i.e. the pallet upper surface and two shelves, for accommodating objects in vertically stacked rows of approximately equal height.

(00048) Fig. 7 depicts the lower pallet unit 12 loaded with objects 59 on upper surface 22 and shelves 58 and illustrates vertical dividers 60 between adjacent objects in each row. The front stabilizing bar 29a is shown removed in Fig. 7. Fig. 8 depicts the loaded lower pallet unit 12 with packing material 61 applied around the objects and with the front stabilizing bar 29a attached to the left and right front posts 28. The packing material 61 may vary depending on the objects and the type of protection needed for the objects, and packing material may not be required for some objects. In the illustrated embodiment, the packing material 61 comprises a band of material encircling the objects 59 of each row and disposed inside of the frame 20 of the pallet unit 12. The packing material 61 can be easily applied around the objects after the objects have been loaded on the pallet 18 and shelves and is easily removed without the need for rearranging or moving the objects. Removal of the front and/or rear stabilizing bars facilitates loading of the objects on the pallet unit 12 and also facilitates the application and removal of the packing material 61. Once the lower pallet unit 12 is in the loaded and packed condition shown in Fig. 8, the connectors 16 are assembled to the lower pallet unit by inserting the lower extensions thereof into the longitudinal passages in the upper portions of posts 28 as described above. The upper pallet unit 14, loaded and packed in a manner similar to the lower pallet

unit 12, may then be assembled to the lower pallet unit by lifting the upper pallet unit over the lower pallet unit to align the bores 152 in the pallet 118 with the upper extensions of connectors 16 and then lowering the upper pallet unit onto the lower pallet unit so that the upper extensions of the connectors are received in the bores 152 as described above and as shown in Fig. 9. The thusly assembled loaded and packed pallet rack 10 may then be loaded onto a truck or other carrier and transported to another destination. The stabilizing bars and packing material prevent the objects 59 from toppling or falling off of the pallets. Even fragile objects 59 such as pottery can be safely stored and transported on the pallet rack 10. The pallet rack 10 in the loaded or unloaded condition can be disassembled by lifting the upper pallet unit 14 from the lower pallet unit 12 to remove the upper extensions 38 of connectors 16 from the bores 152 in the upper pallet 18. The individual loaded pallet units 12 and 14 may be used as a point of sale display as shown in Fig 7 by removing the packing material and at least one of the removable stabilizing bars to permit the objects 59 to be removed from the pallet units in an organized manner while providing protection for the objects.

**(00049)** Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all subject matter discussed above or shown in the accompanying drawings be interpreted as illustrative only and not be taken in a limiting sense.